NUMBER EIGHTEEN NOTES FROM THE SHOP

Woodsmith™

TECHNIQUES:
HOW TO BUILD A RAISED PANEL DOOR

JOINERY:
HAUNCHED MORTISE & TENON

HOW TO BUILD DRAWERS

PROJECTS:
COMPLETE PLANS FOR BUILDING A COLONIAL DRY SINK

COLONIAL WALL-HUNG CHINA HUTCH

BED-SIDE STAND

Woodsmith

Number Eighteen **November, 1981**

Editor
Donald B. Peschke

Art Director
Ted Kralicek

Assistant Editor
Steve Krohmer

Graphic Designer
Marcia Simmons

Subscription Manager
Sandy J. Baum

Subscription Assistant
Christel Bork

Administrative Assistant
Connie L. Lowe

Contributing Editor
Adolph E. Peschke

WOODSMITH (ISSN 0164-4114) is published bimonthly (January, March, May, July, September, November) by Woodsmith Publishing Co., 2200 Grand Ave., Des Moines, Iowa 50312. **WOODSMITH** is a registered trademark of the Woodsmith Publishing Co.

Sawdust

ABOUT THIS ISSUE

I want to admit something I probably shouldn't. I'm not paticularly fond of Early American furniture. Wait, before you cancel your subscription, maybe I should qualify that statement. I do like the looks of it — it's warm and friendly, and it's the furniture I grew up with.

What I don't like is building it. Most of the plans you see for Early American or Colonial furniture specify pine as the wood to use. The next sentence usually says: "Because pine is a softwood and relatively easy to obtain, it's easy to work with." Nonsense.

It's true that pine is a softwood — which simply means that it comes from coniferous (cone-bearing) trees. It's also a low-density wood, so it feels "soft" to the touch. But I don't think it's the least bit easy to work with.

In fact, it's very difficult to achieve good results with pine. It splinters and smashes during joinery. It must be handled with care so you don't scratch or dent it. Pine requires a tedious process of finish sanding to make certain all the scratches are out of it. And after you've gone through all that, pine is usually stained to show you exactly where you goofed. I'd much rather work with hardwoods.

FOUR MORE PAGES. With this issue of *Woodsmith*, we increased the size to 24 pages. Now for the bad news. There's no increase in the price. And even worse, there's still no advertising.

In these times, I know this all comes as a shock. But think of the alternative. If we charged more money, we would hire more people, and eventually *Woodsmith* would be mailed on schedule.

Just when you're getting used to *Woodsmith* being two or three weeks late, you'd have to give up all that anxiety about whether your copy was lost in the mail, or if we went out of business, or just where is it, anyway?!

Seriously, we wanted to add the extra pages to expand the amount of art and text for each project. Three of the projects in this issue take up 4 pages.

In the past we've been reluctant to run 4-page projects, but then we were always trying to cram a lot of information into a few pages. I know we'll never have as much space as we want, but this is an attempt to go in the right direction.

JOINERY. For almost two years now we've been showing a lot of projects that use mortise and tenon joinery. And along the way we've tried to feature the step-by-step procedure for cutting all sorts of variations of this joint.

It wasn't until this issue that it finally dawned on me that we've never had a complete article on the real workhorse of this joint: the haunched mortise and tenon. This is the best joint to use for building raised-panel doors. So it seemed like an essential part of this issue.

LATE NOTE: There's a great new series on T.V. this fall — and it's even better than "Dallas." It's called *The Woodwright's Shop*. The 'star' of this series is a young man named Roy Underhill, the master woodwright for Colonial Williamsburg.

I've seen the first three parts (of a 13 part series) in which Roy talks with great enthusiasm about the old ways of working with wood. So far he's felled a tree, made a shaving horse from a 5' chunk of oak, and then used the shaving horse to make a garden rake.

The setting for the series is Roy's own shop in North Carolina where he demonstrates how to build a variety of projects with his collection of old tools, and his understanding of old methods.

The series is well worth looking into. It airs on PBS (the Public Broadcasting System). You'll have to call your local station to find out the day and time. (Here in Des Moines it's on Saturday morning a 10:00 AM — right up against Bugs Bunny.)

NEW FACES. We've added three more faces to the growing crowd at *Woodsmith*.

Marcia Simmons started work here about three months ago. She's working with Ted on the art and graphics. (Her first project was to design the wrapper we're using to protect the issue.) We also managed to get her back in the shop to help out with some of the building, and she "volunteered" to take a course in caning (a technique we'll be featuring soon).

Steve Krohmer is our new assistant editor. He got here just in time to put together the Tips & Techniques page, and is now working on the index for all the past issues. Steve formerly worked at Frank Paxton Lumber Co. (a chain of hardwood lumber yards) where he gained a sound understanding of wood and how it's used.

Christel Bork is helping out with the subscriptions, and trying to keep our new computer in line.

COMING UP. In the next couple of issues we'll be running articles on how to sharpen chisels and plane irons, how to work with a hand plane, and how to cut dovetail joints.

Also, in the next issue (January) I hope to publish a complete index of all the projects, techniques, and information shown in the first three years of *Woodsmith*.

NEXT MAILING. January, 1982.

Tips & Techniques

BRASS SCREWS

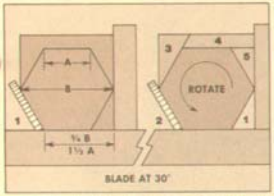
When fastening cabinet hardware with brass (or other soft metals) flathead screws, it takes very little torque to twist the head off the screw. Even pre-drilled pilot holes do not seem to eliminate this problem.

What works for me is to pre-thread the pilot hole with a hardened steel screw of exactly the same size as the brass screw. The steel screw is then removed and replaced with the brass screw with little fear of twisting the head off.

Mort Dearing
Greensboro N. C.

EASY HEXAGONS

After wrestling with having to cut a hexagon, I have come up with a solution slightly different than yours (*Woodsmith* Number 16). In your article you assume the hexagon is in the center of the square,



and make six cuts. However, if you move the position of the hexagon to the bottom of the square, it can be made in five cuts.

First rip a square stick down to the final side-to-side dimensions you want. Then tilt the blade 30°. The distance from the fence to the blade is set at ⅔'s the width of the hexagon (this is 1½ times the final width of each side). Now make the first cut. For the second cut, turn the stick end for end. Then for cuts 3, 4, and 5 simply rotate the stick 60° counter-clockwise.

Pete M. Ebersole
Atlanta, Georgia

ROUTER TABLE FOR PLANNING

Here's a easy way to plane lumber to custom thicknesses on a router table. Place a ¾" flat bottom bit in the router and raise it ⅛" above the router table. Place a piece of ⅛" plywood up to the bit and cut a half circle out of it so it will slightly overlap the bit. Next, attach the plywood to the back side of the router table so that the bit barely extends into the half circle, countersinking the screws. At this point, the bit and the plywood should be flush.

For the first cut, push the wood against the plywood and feed it into the bit. The result will be a ⅛" deep rabbet. Place this over the ⅛" plywood and feed it through again. Make as many passes as needed to get down to the thickness you need.

Joey Traylor
Carrollton, GA.

SAW PROTECTORS

A good way to protect the edge of your high quality hand saws is with a piece of old garden hose. Slit the hose down its entire length and cut it off to the length of the saw blade. Simply slide it over the cutting edge and you can protect your tools and your fingers.

Bud Bezark
San Jose, Calif.

SHEET ROCK SCREWS

I have found that hardened steel sheet rock screws work well for assembling cabinets, shelves, jigs, and the like. They come in sizes from 1" to 3½" inches long and cost only about $2.50 per pound. They have phillips heads and can be used with either a screwdriver or a clutch driven power driver on a drill.

They are very economical and I have found multitudes of uses for them in my shop. They even work well with composition board.

Roger Urce
Saint James, N.Y.

REMOVING GLUE

Have you ever stained a project, only to find you missed cleaning off some of the glue? An easy way to eliminate this is to add a bright color of food coloring to the glue. It does not affect the glue properties and shows up well against the wood so you can remove it all.

Dan Henderson
Cedar Falls, Ia.

REUSABLE SHELF SUPPORT JIG

When I want to install L-shaped metal or plastic shelf supports, I use a simple drilling jig. The jig is a strip of wood ½" thick, 2" wide, and can vary in length.

First I drill a series of equally spaced holes in the wood strip. Then I insert a T-nut in each hole.

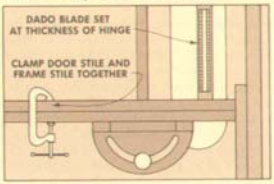
The T-nuts keep the bit from wearing out the holes in the jig. I use the No. 18 x 5/16" size T-nut and a 5/32" bit. The back edges of the strip should be beveled at 45°, and the ends pointed, to allow for glue build up in the corners of the cabinet.

Jim Jacobs
Hastings, Minn.

DADO FOR HINGES

When hanging a flush cabinet door, sometimes it is difficult to mark the hinge positions exactly on both the door and the stiles, especially if several doors are to be hung.

If both the doors and the stiles are cut to the same length and clamped together, the edges of both can be dadoed on the table saw before assembly. To do this I use the cut off fence and a fixed block as a guide. The depth of cut will vary with the hinge size, but may be as little as 1/32".



After assembly, material can be removed as needed from the top and bottom of the doors to fit the opening. It is also helpful if the holes for the hinge screws are centered and reamed before the members are assembled.

Blake Tewksbury
Francestown, N.H.

SEND IN YOUR IDEAS

We invite you to share your woodworking tips and techniques with other readers of *Woodsmith*. We will pay a minimum of $5 for a tip, and $10 or more for a special technique. All material submitted becomes the property of Woodsmith Publishing Co. Upon payment, you give *Woodsmith* the right to use the material in any manner for as long as we wish.

If your idea involves a drawing or photo to explain it, do your best and, if necessary, we'll make a new drawing, or build the project or jig and photograph it. (Any drawings or photos submitted cannot be returned.)

Send your ideas to: *Woodsmith*, Tips & Techniques, 2200 Grand Ave., Des Moines, Iowa 50312.

Bed-Side Stand

A PLACE FOR YOUR ELECTRIC SUN DIAL

You know, Don, you ought to include some small projects for the guys who are just starting out in woodworking. Most of the projects you show are rather large and complicated. It would be nice to have a few small things just to get the hang of some of the basics.

Don: We receive a lot of letters along this vein. So we designed this Bed-Side Stand as a small project to get the hang of the basics.

Are you kidding? There's a lot of work in this bed-side stand. Just building the door and drawer is quite an undertaking.

Don: That's true, but I always think if you want to get into this, you might as well jump in with both feet. Besides, it's not all that difficult, it just takes a little time. And once you're done, you certainly won't be "just starting out" anymore.

BUILDING THE SIDES

I started work on this cabinet with the sides. The easy way out would be to build the sides out of plywood. But when you're done, all you have is a plywood cabinet. Using solid wood is a little more difficult, but I think it's worth the effort.

I used clear pine boards to build this cabinet, see Cutting Diagram. Construction pine could be used, but the knots will cause a lot of problems. For this project, clear pine is probably worth the price.

The first step on the sides is to rip 6 boards 2¾" wide and about 27" long for each side. I arranged these boards to get a nice grain pattern, and edge-glued them to get two slabs.

Shop Note: When gluing up boards like this, most books show that you should alternate the *end* grain pattern on the boards so on one board the grain curves up, on the next board it curves down, etc. However, since I smooth the glued-up boards with a hand plane, it's much more important to arrange the boards so the *face* grain is going in the proper direction for planing.

You need at least four pipe clamps to get these boards glued together. When the glue was dry, I scraped off the excess at the joint lines with a paint scraper. Then it was a matter of getting these slabs smooth.

I used a *Record* jack plane to smooth down the sides and then finished off with a scraper blade (see *Woodsmith* Number 15). This smoothing down process could also be done with a belt sander or with a Wagner Safe-T-Planer. (These techniques are described in *Woodsmith* Numbers 10 and 15.) The final step is to trim the slab to final width (ripping it down the edges) and to final length (I used the panel jig shown on page 23.)

DADOES FOR THE SHELVES. Once the sides are smoothed and squared up, dadoes are cut for the 'shelves.' The top shelf is actually a support for the drawer, and the bottom shelf is simply the bottom of the cabinet. In the good old days these shelves would have been web frames (frame and panel construction), but even I will admit that web frames are a lot of (unnecessary) work. I used ½" plywood.

The one big problem with using plywood here is that plywood is very stable, while the solid wood sides will expand/contract with seasonal changes in humidity. So, the plywood is not actually glued into the dadoes, it just rests in them.

I got off the track, back to the dadoes. The two dadoes (see Fig. 1) are ½" wide and ¼" deep, and they are stopped 1½" from the front edge. I cut them with a router by clamping a fence (straight edge) to the sides.

TWIN MORTISE AND TENON. As mentioned above, the plywood shelves are not glued into the dadoes, so there must be another way to hold the sides of the cabinet together. I did this the old-fashioned way with rails (horizontal dividers).

Each of the six rails is joined to the sides of the cabinet with twin mortise and tenon joints. First, I marked out the positions of the six twin mortises on the two sides, Fig. 1. The top two twin mortises are open on the top edge (which is okay because that end of the mortise is end grain and not a gluing surface anyway).

Shop Note: It would seem to be a lot easier to cut a single mortise across the grain, rather than hasseling with this twin mortise stuff. However, a mortise is never cut across the grain. It's always cut with the grain to provide a proper gluing surface.

The other four twin mortises are for rails that will support the shelves. The two on the front are laid out so the top edge aligns with the top edge of the dadoes. The two on the back have their top edges along the bottom of the dado.

To cut these mortises, I marked them out with a pencil first. Then I used a drill mounted in a *Portalign* attachment to drill out most of the waste. Finally, I chopped all four sides square with a butt chisel. This sounds like a lot of work, but it goes pretty fast once you get in the swing of it.

RABBET FOR BACK. The final step on the side pieces is to cut the ¼" x ¼" rabbet on the back edge for the plywood back.

THE RAILS

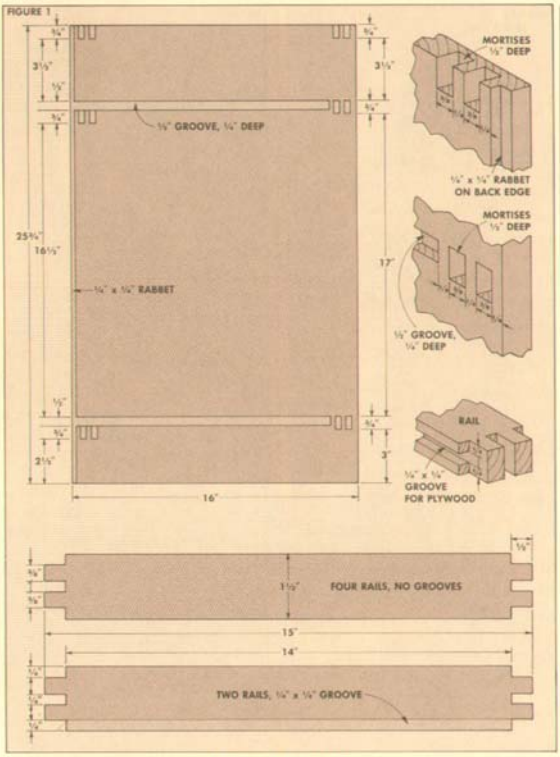
Now you have to decide how wide you want the cabinet. I settled on an inside width of 14". The rails must be cut (Fig. 2) so the distance between the shoulders of the tenons is exactly 14". To this measurement, I added a total of 1" for the two ½" long tenons.

I cut these tenons by hand (with a dovetail saw and chisel) because I think it's easier than on a table saw or radial arm saw. (This procedure is detailed in *Woodsmith* Number 12.)

If you want to cut them on a table or radial saw, make the outside cuts first (these are really just rabbet cuts). This can be cut the same way regular tenons are cut (described on page 4). Then the rail is mounted in a tenon jig and the section between the two tenons is cleaned out.

Finally, a ¼" x ¼" groove is cut on the inside edge of the two front rails to hold the plywood shelves in place.

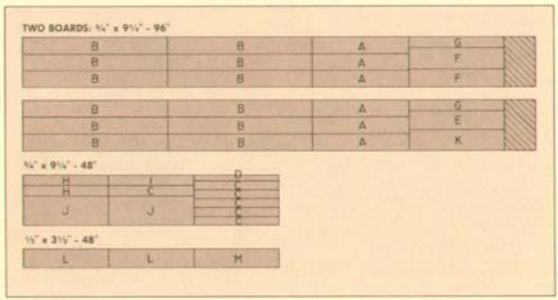
FIGURE 1

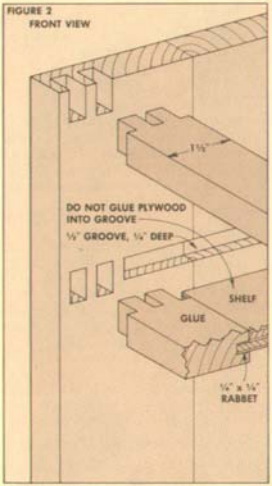


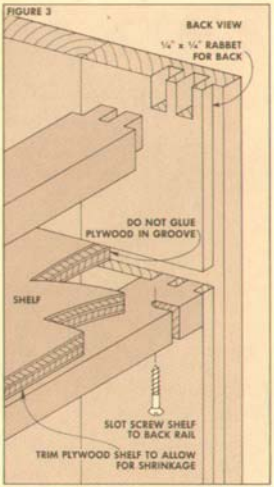
MATERIALS LIST

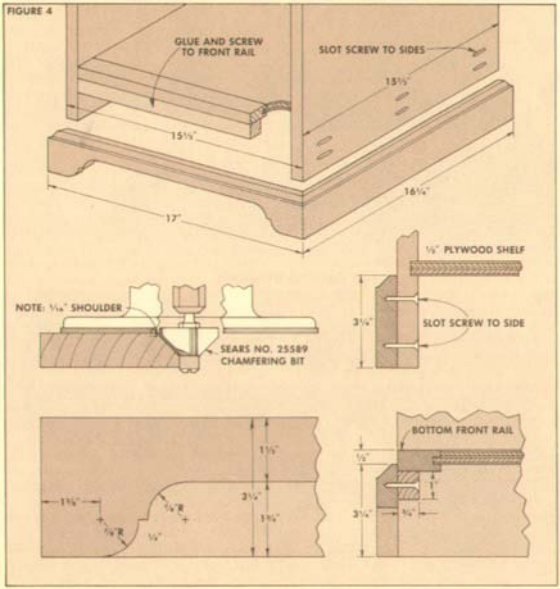
Overall Dimensions: 26½"H x 17"W x 17"D	
A Cabinet Top (6 pcs)	¾ x 2⅞ - 17
B Cabinet Sides (12 pcs)	¾ x 2⅞ - 25¾
C Cabinet Rails (6 pcs)	¾ x 1½ - 15
D Mounting Rail	¾ x 1 - 14
E Base Front	¾ x 3¼ - 17
F Base Sides (2 pcs)	¾ x 3¼ - 16¾
G Door Rails (2 pcs)	¾ x 1½ - 13½
H Door Stiles (2 pcs)	¾ x 1½ - 17½
I Door Stile (Middle)	¾ x 1½ - 16½
J Door Panels (2 pcs)	¾ x 5⅝ - 14⅜
K Drawer Front	¾ x 4 - 14½
L Drawer Sides (2 pcs)	½ x 3¼ - 14½
M Drawer Back	½ x 2½ - 13¼
N Drawer Bottom (ply)	¼ x 13 - 13⅞
O Cabinet Back (ply)	¼ x 14½ - 23¼
P Cabinet Shelves (ply)	½ x 14½ - 14½

CUTTING DIAGRAM









ASSEMBLING THE CASE

At this point go ahead and dry-clamp all the pieces together to check the fit. Figures 2 and 3 give a pretty good indication of how the case goes together.

If the twin tenons are too long (that is, if the shoulders don't come in full contact with the sides), simply trim off the ends a little. (These shortened tenons won't hurt the strength of the joint. In fact they probably should be a little short.)

PLYWOOD SHELVES. While the cabinet is dry-clamped, take measurements for the plywood shelves. A rabbet is cut on the front edges of both shelves, leaving a tongue to fit in the groove in the front rails, Fig. 2. The edges should fit snugly in the dadoes in the sides of the cabinet, and the top surface should be flush with the top of the front rails.

The back edge of the shelves is trimmed about ¼" short of the back rail. This is to allow room for the initial contraction (dry-down phase) of the pine sides.

SLOTTED SCREWS. While you're at it, go ahead and cut the slots for the screws on the back rails, Fig. 3. (To do this I drill a pilot hole and then cut out a slot with a sabre saw.) This slotted screw arrangement holds the shelf down on the rail and yet allows the sides of the cabinet to move.

GLUING UP. Once everything checks out, you're ready to glue up the cabinet. First, apply glue to all the twin mortise and tenon joins and use pipe clamps to fasten them together.

Before the clamps are fully tightened, slide the plywood shelves in the grooves. (It's helpful to have them in place now to hold the cabinet square.) Spread some glue on the front tongue, and shove it into the groove in the front rails. (Note: Do not glue the edges of the plywood into the grooves in the sides. The solid-wood sides must be free to move.)

You can get by with four pipe clamps, two on the top between the top two rails, and two on the bottom rails. (Using six clamps is better — one at each rail.) As the clamps are screwed tight, constantly check the square of the cabinet.

THE PLINTH

Now it's starting to look like a cabinet. The next step is to add the plinth (the base board). I cut the three boards for the plinth, 3¼" wide and a little long to begin with. Then I cut a shouldered chamfer along the top edge of each board. (I did this on a router table.)

A simple decorative relief is cut along the bottom edge of the front board. As shown in the detail in Fig. 4, this is marked out with two ⅜" radius arcs, connected with a ½" shoulder.

MOUNTING THE PLINTH. The front board

of the plinth is mounted to the cabinet first. I glued a small mounting strip to the bottom of the rail. Then pilot holes were drilled through the mounting strip and into the front board.

Do not glue these side boards to the sides of the cabinet. Instead, drill two or three pilot holes side by side to create for a slotted screw arrangement.

THE TOP, DOORS AND DRAWERS

The top is a square board, glued up just like the sides. After it was cut to size, I cut a chamfered bevel around the four edges to match the drawer front.

THE DOOR. The basic step-by-step for building the door frame is given on pages 8 and 9. They're lipped doors, overlapping the edges of the cabinet ¼". The only difference is that I added a center rail in the frame so there would be two narrow panels.

The four corners of the door frame are joined with haunched mortise and tenon joints. Then the center rail is added with a simple mortise and tenon, making sure it is centered between the two stiles, Fig. 8.

Since the panels for this door are only 5" wide, the depth of the grooves in the door frame need only be ¼".

THE PANELS. Dry-assemble the door frame and get the final measurements for the panels. The chamfered borders are 1 5/16" wide, with an 1/16" shoulder between the border and the field. This worked out to an 11° angle.

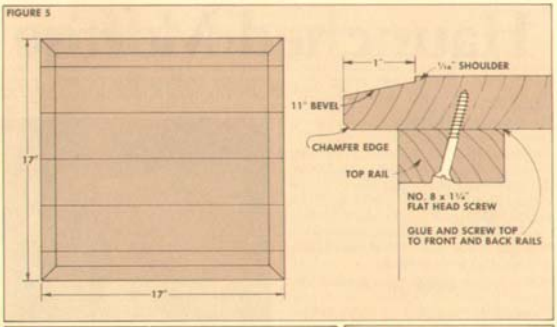
After the borders are cut, a rabbet is cut on the back edges of the panels so they slide easily into the grooves in the frames. When gluing up the doors, do not glue the panels in the frames — just let them float.

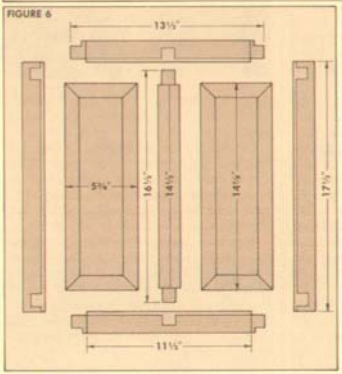
THE DRAWER. The last step is to build the drawer. The basic dimensions of this drawer are shown in Figure 9. The drawer front is cut with a raised field to match the panels and the cabinet's top. The angle of cut is still 11°, but the width of the border is reduced to 1"

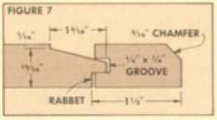
The sides of the drawer are joined to the front and back with rabbet and groove joints on all four corners. (See page 20 for detailed description of this joint.)

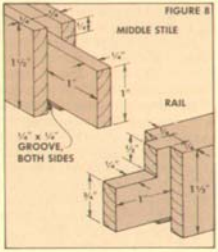
FINISHING. For this Bed-side Stand, I tried a stain I hadn't used before:: *ZAR* Wipe-On Wood Stain. I can't say I was happy with the results. The *ZAR* stain is called a wiping stain, but it seems more like a thin paint. I had a lot of difficulty with it, but that could be my inexperience with this product.

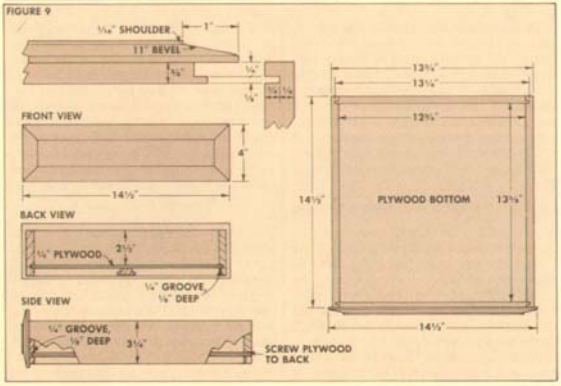
I also wanted to try the *ZAR* Wipe-On Tung Oil Varnish. I was much happier with the results of the *ZAR* finish. It's much thicker than other tung oil vanishes (so drips and runs are a bit more of a problem). But it yields a thick high-gloss finish that was really quite nice considering the ease of application.







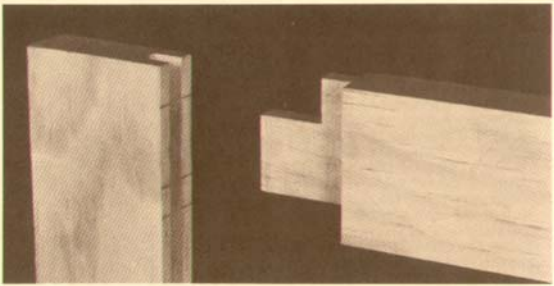




Haunched Mortise & Tenon

THE IDEAL JOINT FOR RAISED-PANEL DOORS

The ideal joint for building frame and panel doors is a haunched mortise and tenon. The nice thing about this particular joint is that you can cut a groove (for the panel) down the full length of all four pieces of the frame. Then, when the tenon is cut, a haunch (the extra little shoulder on the top edge of the tenon) is cut so it conceals the small gap left on the ends of the stile. A neat and tidy arrangement.



LAYING OUT THE CUTS

Although the actual cutting of a haunched mortise and tenon is quite easy, laying out the cuts for a frame and panel door takes a little head work. (Fortunately, I have a little head so it makes things easier.) From here on I'll use the doors on the Dry Sink as an example.

The doors we used on the Dry Sink are lipped. That is, a ⅜" x ⅜" rabbet is cut on the back of all four sides of the door, leaving a lip on the front. (This ⅜" x ⅜" rabbet is the proper size to accommodate the hinges.) We wanted this lip to extend only ¼" onto the facing frame, leaving a ⅛" clearance all around.

The first step in making the door frame is to measure the door opening in the case and cut the *stiles* (verticle pieces) and *rails* (horizontal pieces) to width (2" in this case), and to approximate length.

The stiles can now be cut to final length. Since we wanted the door to overlap the frame ¼", the stiles are cut a total of ½" longer than the height of the opening. The length of the rails, however, takes some figuring.

To determine the length of the rails: 1) measure the width of the door opening, 2) add ½" for the lips, 3) subtract the combined width of the stiles (4" total for two 2"-wide stiles), 4) add the length of the two tenons (in this case the tenons are 1¼" long, so add on a total of 2½"). If both of the rails are cut exactly to this dimension, it will save a lot of time later. (I used a panel cutting jig to cut them to equal length, Fig. 1.)

CUTTING THE GROOVES AND MORTISES

At this point, I arrange the four sticks for the frame to get a nice grain pattern. Then I mark the face sides (the sides that will show) with an 'X.'

The first step is to cut the grooves, Fig. 2. It's important that these grooves are exactly the same width as the mortises will be (in this case ¼" wide).

To cut the grooves, I use an adjustable dado head and make a trial cut in a piece of scrap. To check the width of the groove, I use the bit that will be used to drill out the mortise.

CUTTING THE MORTISES. After the grooves are cut in all pieces, the mortises can be cut in the stiles. To mark out the boundaries of the mortise, mark the width of the rail on the inside edge of the stile Fig. 3.

However, the mortise is actually going to be much shorter. Mark another line ⅜" in from the first line to allow for the depth of the groove. Then mark a third line ½" from the end of the stile to allow for the ⅜" lip on the back of the door, plus a little extra so the lip doesn't interfere with the tenon, see Fig. 4.

Finally, mark a line on the end of the stile to indicate the depth of the mortise (1¼"), and use this line to adjust the depth stop on the drill press, Fig. 5. With the stile in place ("x" side against the fence), drill a series of overlapping holes to rough out the mortise, Fig. 6.

At this point you have a choice of how you want to go. You can leave the ends of the mortise half-round and later round-over the tenon to match, or you can square up the ends of the mortise with a chisel and leave the edges of the tenon square.

CUTTING THE TENON

The traditional way of cutting a tenon is to stand the rail on end in a tenon jig and cut the two faces first, then finish it by cutting the shoulders. I'm not particularly fond of this method. I think it's much better (more accurate) to cut the shoulders first. Once this cut is made, it's simply a matter of making a series of similar cuts to finish it up.

The first step is to set the depth of the blade, Fig. 7. Then adjust the distance between the fence and the outside of the blade so the fence can be used as a stop. (The depth-stop mark on the end of the stile can be used to set the fence, Fig. 8.)

When you're ready to make the cut, hold the rail firmly against the miter gauge, and push the end of the rail up against the fence, Fig. 9. (Note: It's a general rule that you can't use the miter gauge and fence at the same time, but in this case you're not making a through cut so it's okay.)

After making the shoulder cut, just continue to make a series of cuts to clean off the face of the tenon, Fig. 10. Since most cross-cut blades will leave a sort of rippled surface, the final step is to move the face of the tenon over the blade, pushing it back and forth to clean off the roughness.

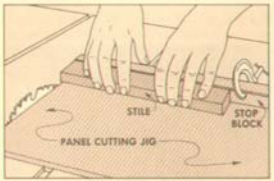
If the rail has been cut to the proper length, all you have to do now is flip the rail end for end (with the same side down) and repeat steps 9 and 10. However, I usually mark the shoulder on the other end and make sure the blade is cutting exactly on this shoulder line.

The other side of the tenon can now be cut. Check the depth of cut with the stile (repeat step 7). Even though it may check out okay, I make a trial cut out at the end of the tenon first and check the fit in the groove (Fig. 11).

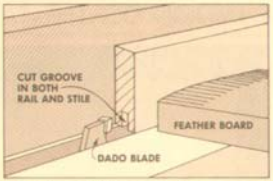
Finally, the top edge of the tenon is trimmed to leave a haunch to fit in the groove in the stile. There's no way to use the stile to gauge these cuts, so you have to measure it, or just sneak up on the cut until it fits.

That's it. The tenon should now fit neatly in the mortise. There should be just a little pressure involved in getting it in . . . kind of a sssha-chunk.

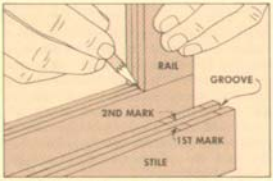
Step By Step



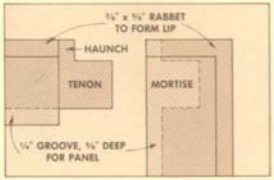
1 *It's very helpful if all the rails and stiles are cut to the same length before cutting the mortise and tenon joints. I use a panel cutting jig to do this.*



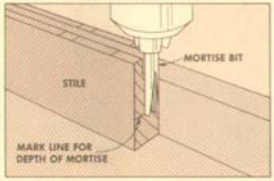
2 *Place the 'X' side of each piece against fence and cut grooves with adjustable dado. Check width of the groove by using the bit for drilling mortise as a gauge.*



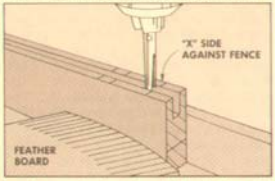
3 *Place end of rail on stile to mark maximum width of mortise. Mark second line to allow for depth of groove, and third line to allow for lip on door.*



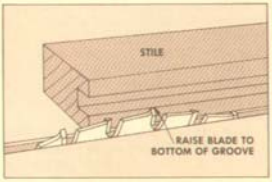
4 *The mortise is limited by the size of tenon. Note that the groove on the rail cuts off part of the tenon, and allowance must be made for the lip on the door.*



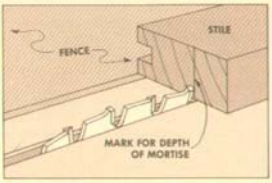
5 *Mark a line on the end of the stile to indicate the depth of the mortise. Lower the bit to this line and adjust the depth stop on the drill press.*



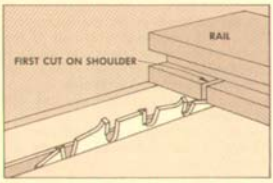
6 *Use a feather board to hold the stile firmly against the fence on the drill press. Then drill a series of overlapping holes to rough out the mortise.*



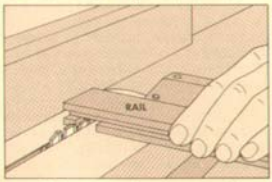
7 *The depth of cut for the tenon can be accurately gauged by using the stile. Place stile face side down and adjust blade to the bottom of the groove (mortise).*



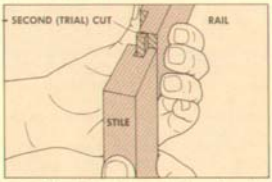
8 *The shoulder cut on the tenon is the same as the depth of the mortise. Use the depth stop mark on the stile to adjust distance between the fence and blade.*



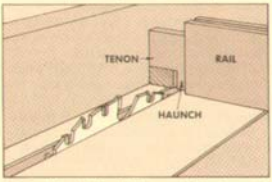
9 *To make the shoulder cut, hold rail against a miter gauge, and push it against the fence. This is not a through cut so it's okay to use fence as a stop.*



10 *Make repeated passes out to the end of the tenon to finish the cut. Clean up the face by moving face of tenon back and forth over the center of the saw blade.*



11 *Flip the rail over to the other side and adjust the blade height. Then make trial cut at the end. Check the fit of the tenon in the groove: it should be snug.*

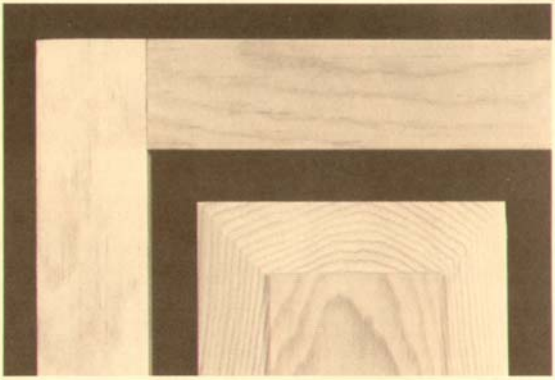


12 *Adjust the blade and the fence to trim the top edge off the tenon to form the haunch. This cut can't be gauged, so sneak up on it slowly.*

Building Raised Panels

LET THE WOOD DO THE TALKING

Raised-panel doors are the hallmark of Colonial furniture. I imagine one of the primary reasons this style of furniture has remained so popular over the years is the subtle impact of the raised panel. It's wood. And it's on display — with much the same effect of framed painting, except in this case the natural beauty of a wood panel is highlighted.



THE DOOR FRAME

There are several ways of mounting a panel into a door frame. The one that we used on the three projects in this issue is to build the door frame using haunched mortise and tenon joinery (previous page).

Grooves are cut on the inside edges of the frame to accommodate the panel. If the frames are made of ¾"-thick stock, the *width* of the groove is typically ¼". The *depth* of the grooves depends mostly on the size to the panel to be inserted.

If the panel is fairly narrow — say, less than about 6" — the grooves can be ¼" deep. For wider panels the grooves should be about ⅜" deep. The reason for the difference in depths is to allow for dimensional changes in the size of the panel as there are changes in the moisture content of the wood.

Actually, two types of changes occur. There's the expansion/contraction of the panel during changes in humidity (summer to winter). But another key consideration (that's often forgotten) is the moisture content of the wood when the panel is first constructed.

Most frame and panel doors used on Colonial or Early American furniture are typically made of pine. Almost all pine sold today is kiln dried to about 18% moisture content. This can present a real problem, because once the panel is built and the piece of furniture finds its home, the wood will try to reach an equilibrium with the relative humidity of the room. This almost always means that it will lose water content . . . drying down to about 6% to 8%. The result is a shrinking panel.

Following this initial 'dry down' phase the panel will expand/contract with the seasonal changes in humidity. So, both the initial dry-down and the seasonal changes in the panel must be considered when cutting the grooves in the frame, and when cutting the panel to size.

CUTTING THE PANEL. If the panel is going to be wider than about 6", it's best to glue up several boards to make the panel. Select the boards for the panels, arrange them to yield the best results for grain pattern (see Shop Notes, page 23), and edge-glue them together.

As with all other forms of edge gluing, I prefer to use a simple butt joint — no dowels or splines. (This procedure is exactly the same as that described in *Woodsmith* Number 15 for gluing up a table top.) Once the glue has set, I use a hand (jack) plane to smooth the panels down to a flat surface.

If pine is being used for the panel, I usually cut the panel a short ⅛" less than the groove to groove measurement in the frame. This allows the panel to contract slightly during the initial dry-down phase, and then when it reaches its 'normal' size there will be ample room for it to move with seasonal changes in humidity.

DETERMINING THE ANGLE OF CUT

Once the panel is cut to size, the next step is to cut the chamfered border. (A chamfer cut goes from an edge to a face, a bevel cut goes from face to face.) There are two considerations when cutting this border: the angle of the cut, and the placement of the cut. These then depend in part on the appearance you want, and in part on the physical restrictions of the frame.

The width of the chamfered border varies according to the size of the panel. In general, the wider the panel, the wider the border. For a narrow panel (less than 8") the border need only be about 1" wide, on larger panel you may want to go up to 1½" wide borders.

However, once you've decided on a certain width for the border, you must go through some figuring to get things to turn out properly.

At this point we need to talk numbers, so let's say you want to make a panel that's ¾" thick and 12⅝" square. (This just happens to be the size of the panels in the Wall Hutch in the issue.) The groove-to-groove measurement of the door frame is 12¾". So the panels are cut about ⅛" less than this measurement (12⅝").

Now you have some decisions to make. The panel can be cut so the field is flush with the surface of the frame, or so it is raised slightly above it. Also you must decide how wide the border will be.

For this panel we decided the width of the border would be 1½", and the shoulder (between the field and the border) would be ⅛". Finally we decided the field would be raised ⅛" above the surface of the frame. Figure 1 shows the final dimensions of chamfered border of this panel. In fact, this is the same type of drawing we used to determine the angle of the cut.

By drawing lines as shown in Fig. 3, we were able to use a protractor to determine the angle of the chamfer cut for the border (in this case 12°). This same procedure can be followed no matter what kind of panel you want.

CUTTING THE CHAMFERED EDGE

The angled cut on the borders of the panel can be made on either a table saw or radial

arm saw. We're showing both methods on the next page.

TABLE SAW. To make this cut on a table saw, first set the arbor at the proper angle (in this case, 12°). Then raise the blade to a height of 1½", measuring to the highest point on the blade. Next, adjust the fence so the outside of the blade is ⅝" from the fence (this leaves a ⅛" shoulder for the field of the panel.)

Now it's just a matter of making the cut. Hold the panel on one of the ends (both ends are cut first). I stand on the side of the table saw for a little better control and clamp an extra-high auxiliary fence (a piece of plywood) to the metal fence. Then I push the panel through the blade, being very careful to keep my fingers away from the path of the blade, Fig. 2.

After cutting the chamfered border, the saw is reset to a ⅛" depth of cut (the height of the shoulder on the field), and the fence is adjusted so the outside of the blade just trims off the angled shoulder left by the first cut, Fig. 3.

RADIAL ARM SAW. The procedure on a radial arm saw is very similar. However, in order to make this type of cut, I switched to a 7" blade (from a circular saw). Also I cut a new fence with a 'window' for the blade, and made sure the bottom of the window was about ⅛" above the level of the table so the edge of the panel would have something to ride against.

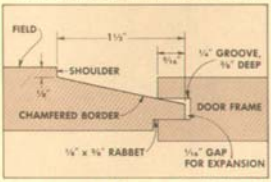
Set the angle of the blade (12°), adjust the height and the distance from the fence, and make the cut. (Again, be very careful to keep your fingers out of the path of the blade.) Finally, the arm is set in the normal position for a rip cut to trim off the angled shoulder left by the first cut.

CUTTING THE RABBET. The edge of the panel is too thick at this point to fit in the ¼" groove. This little problem is solved by cutting a rabbet on the back edge of the panel.

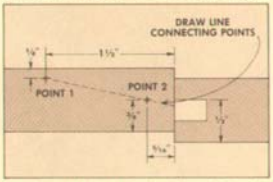
You want to cut this rabbet so the panel is just loose enough to slide in the groove with a little play, but not so loose that it rattles around.

Also, the rabbet should be cut as wide as the groove is deep. This will leave a small gap between the frame and the shoulder of the rabbet to allow for the movement (expansion/contraction).

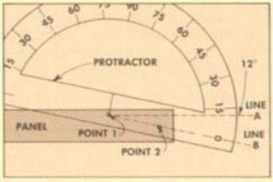
That's it. With a litle finish sanding the panel is ready to be placed in the frame. However, when gluing up the frame, do *not* glue the panel in the groove. It must be free to move (expand/contract).



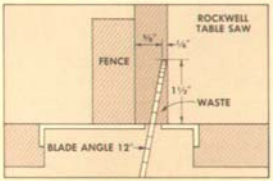
1 LAYING OUT. *We use a sketch like this to lay out cuts for panel. Note that field is ⅛" above frame, and border touches groove, leaving 1/16" clearance.*



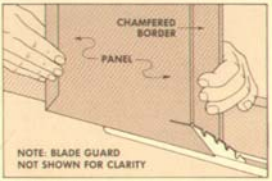
2 *To get the angle of cut for the border, mark two points: 1) where shoulder of the field will meet border, and 2) where border will meet the lip of the groove.*



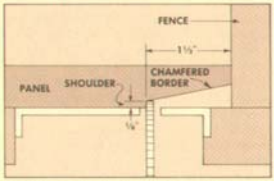
3 *The angle can now be determined with the use of a protractor. Draw Line A from Point 1 through Point 2. Line B starts at Point 1 and is parallel to the field.*



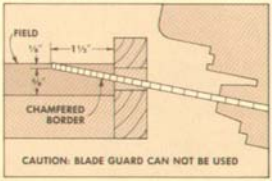
1 TABLE SAW. *To set up cut on a (Rockwell) table saw, raise blade to 1½" (at highest point), and adjust fence so inside of blade leaves ⅝" shoulder for field.*



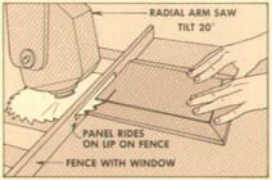
2 *Hold the panel firmly against the fence and make first cuts on end grain. The outside of the blade should poke through at shoulder line of field.*



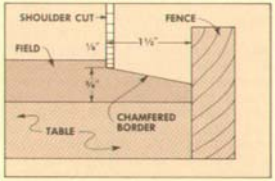
3 *Set blade to depth of shoulder (⅛") and adjust the fence to trim off the angled shoulder left by first cut. Finally, cut rabbet on back so panel fits groove.*



1 RADIAL ARM SAW. *Make a new fence with a window for saw blade. Position fence so there's a shoulder for panel to ride against. Also, remove table behind fence.*



2 *I use a 7" planer blade to make cuts. Note: blade guard cannot be used so keep fingers well away from path of blade. Make cuts on end first, then on sides.*



3 *Swivel the saw head to make a rip cut. Adjust depth of cut to trim off angled shoulder on field left by first cut. Then cut rabbet on back so panel fits groove.*

Colonial Dry Sink

A CLASSIC COMBINATION OF STYLE AND FUNCTION

Most of the time when I look at a piece of furniture I see joinery, or design, or grain patterns. But occasionally there's a piece of furniture that stirs an emotional response.

This Dry Sink is one of those emotional types of furniture. It looks friendly, and I feel at home with it. I suppose a lot of other folks feel the same way and that's one of the reasons dry sinks are so popular.

We spent a lot of time working on the design of this dry sink. Not so much the physical appearance — it looks like almost every other dry sink. But with the joinery, and how it's put together. By far the biggest problem was the 'sink'. Joining the sides of the sink to it's solid wood bottom was a real challenge.

After struggling for some time, it finally dawned on me that this sink is very similar to a drawer . . . an old-fashioned drawer with a solid wood bottom. That was enough to get over the hurdle we were facing, and we could go ahead with the basic construction.

THE FACING FRAME

The sequence of construction we used to build this dry sink may seem completely backwards. We built the facing frame (the frame that supports the doors and the drawers) before building the case.

Why build the frame first? There are three reasons. First, the way the frame is joined to the case (a tongue and groove joint) calls for a rather precise alignment of these two components. It was much easier to build the frame first and then use it as a gauge or template to lay out the dimensions of the case.

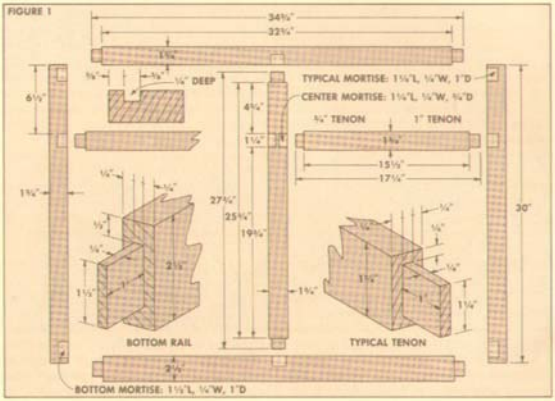
Second, grooves must be cut in the sides of the case to support the drawer shelf and bottom shelf. These grooves must align precisely with the middle and bottom rail on the frame. So, it was better to build the frame first and then mark the position of the shelf dadoes with the frame.

And the third reason: when the case is built and ready to be glued up, the frame is employed as a 'squaring jig' — keeping the sides and shelves square as the case is clamped together.

THE FACING FRAME. The facing frame is built with mortise and tenon joints all around, Fig. 1. (This is the same kind of joint we used for building the doors, except there's no haunch to worry about, see page 8.)

Each member of the frame is 1¾" wide, except for the bottom rail which is 2½". This extra ¾" on the bottom rail is used

FIGURE 1



later to mount the plinth (base board).

After all the joints are cut, ⅜"-wide grooves are cut down the length of the two outside stiles. The inside edge of these grooves should be ¾" (or just a smidgen more) from the outside edge of the stile, see Fig. 2A.

THE CABINET SIDES, RAILS AND SHELVES

Boards for the sides are ripped to 3¼" width and glued up. (Plain edge-to-edge butt joints were used — no dowels or splines.) These two slabs were then planed smooth, and cut to final dimensions, Fig. 2.

The first step on these slabs (sides) is to cut rabbets on the front *outside* edge to leave tongues. (These tongues fit into the grooves in the facing frame, Fig. 2A.) Next, rabbets are cut on the back *inside* edge to accommodate the plywood backing, Fig. 2B.

GROOVES FOR SHELVES. Now place the facing frame on the sides (fitting the tongue into the groove in the frame), and mark the position of the drawer shelf and the bottom shelf, Fig. 2.

The top edge of these grooves must align precisely with the top edge of their respective rails. After marking the position of these grooves, cut the dadoes.

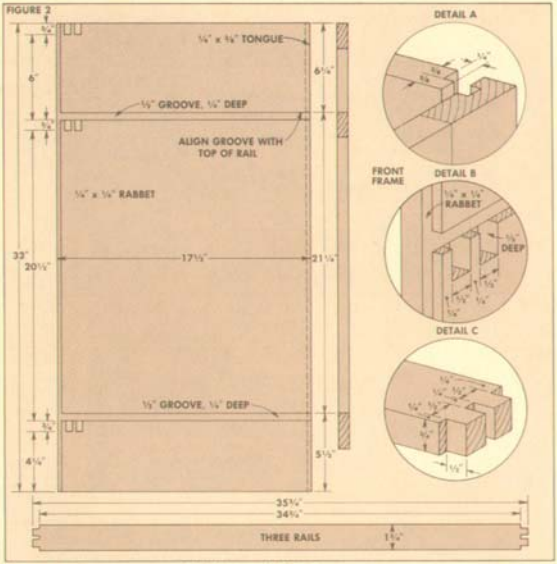
TWIN MORTISES. The last step on the sides is to cut the twin mortises for the back fastening rails, Fig. 2B. These mortises are roughed out with a drill mounted in a *Portalign* attachment and then chopped square with a chisel. (See *Woodsmith* Number 12 for more on this joint.)

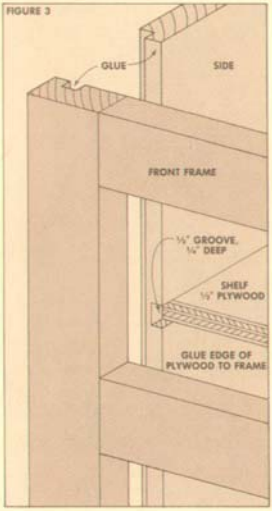
BACK FASTENING RAILS. To cut the back fastening rails, use the groove to groove measurement on the facing frame as a guide to mark the shoulder to shoulder distance on the rails. Then add 1" for the ½"-long tenons on each end, Fig. 2C. One last thing, cut the slotted pilot holes for the screws, see Fig. 4.

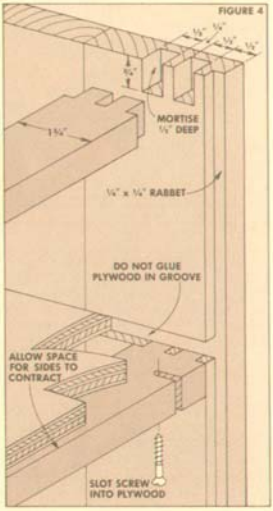
PLYWOOD SHELVES. Go ahead and glue up the basic case: the facing frame, the sides, and the back rails. Then cut the ½" plywood shelves to fit in the dadoes.

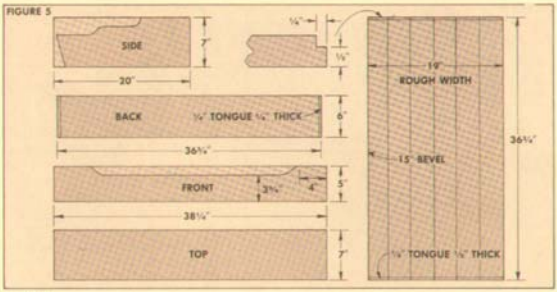
However, since the shelves are plywood and the sides are solid wood, certain precautions must be made when mounting these shelves in the case. The plywood shelves are very stable, but the solid wood sides will move (expand/contract) with seasonal changes in humidity. Also, because the sides are made of pine, there will undoubtedly be an initial 'dry down' phase as the pine (18% moisture content) dries down to the normal 6% to 8% room condition.

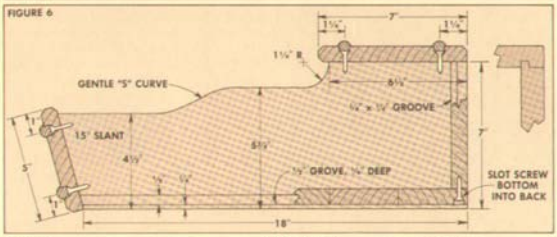
To allow for these two dimensional changes in the sides, the plywood shelves are *not* glued into the dadoes. Instead they are only glued to the front rail on the facing frame, Fig. 3. Also, the back edge of the shelves should be cut about ¼" short (Fig. 4) to allow for the initial dry-down stage.

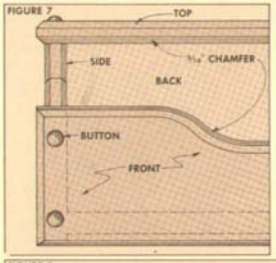


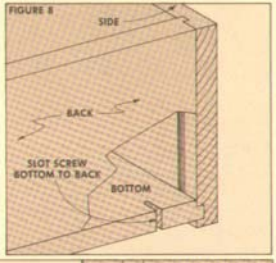


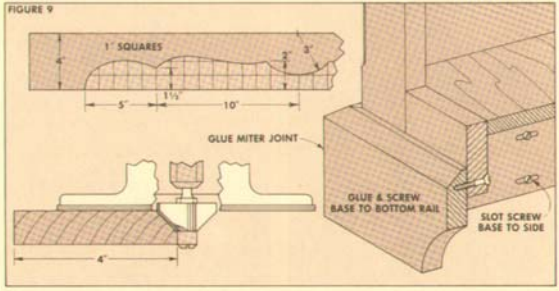












THE SINK

The cabinet is pretty far along at this point. The next step is to build the sink part of this dry sink.

THE SIDES. Work begins with the sides. First, the boards for the sides are cut to a width (7"). Then, before cutting them to length, make a 15° miter cut on the front edge of each piece, Fig. 6.

The length of these pieces is the same as the width of each side on the cabinet. (This should be 18".) After they're cut to length, cut a ½"-wide, groove along the inside bottom edge of each piece. Now the curves can be cut.

Lay out the 1¼" radius curve so it ends 6½" from the back edge, and also mark the gentle S-curve at the center of the top edge, Fig. 6. Finally, the top edges and the outside bottom edge of the sides are chamfered (I did this on a router table).

THE SINK'S BOTTOM. The slab for the bottom of the sink is glued up from 6 boards, 3¼" wide to get a slab about 19" wide and 37½" long. After getting this slab smoothed down, I cut it to width and length, Fig. 5. This gets a little tricky.

First, bevel-rip the front edge at 15°, but leave it wider than needed for now. The final length of the slab is equal to the outside width of the cabinet, plus ½" for the ¼"-long tongues on each end.

Now rabbets can be cut, leaving tongues to fit in the ½"-wide grooves in the sides, Fig. 8. (These tongues can be a little loose, because they will not be glued in the grooves in the sides.)

Finally, place the bottom slab on top of the cabinet once again, aligning the beveled front edge with the front of the facing frame. Now you can mark the back edge and trim the bottom to final size.

THE FRONT. Dry-clamp the sides to the bottom slab to get measurements for the front and back. The piece for the front is cut ½" longer than the outside to outside measurement of this assembly (so it extends ¼" beyond each side). Then the relief (the curved section) on the top edge is bandsawn out, Fig. 7. And finally, three edges are chamfered.

THE BACK. The back is joined to the sides with tongue and groove joints, see Fig. 8. The back is the same length as the bottom, including the extra ½" for the tongues.

THE TOP. The top is cut to width so it hanges ½" over the radius curve on the sides. The length is the same as the front piece (extending ¼" out from the sides). Also, three edges are chamfered, Fig. 6.

ASSEMBLY. Before assembly, finish sand all pieces. Then loosely dry-clamp the sides to the bottom. Apply glue to the tongues on the back piece, and clamp it in place.

Now add on the sink's front piece by pre-drilling counterbored pilot holes at both ends, and glue and screw it to the

sides. Also, spread some glue along the beveled front edge of the bottom piece and clamp it to the front piece. (Note: Only the beveled front edge of the bottom piece is glued in place. The tongues are not glued into the grooves in the sides, they must be free to move.)

To mount the top, once again pre-drill pilot holes, but use a No. 12 pilot bit. Then glue and screw the top to the sides with No. 8 screws. (The extra-large pilot holes allows for expanson/contraction.)

The sink can now be placed on the cabinet. We didn't bother fastening it down because the lips on the sides and the front keep it in place.

THE PLINTH, DOORS AND DRAWERS

A few small tasks still remain. Boards for the plinth (base) are cut (mitered) to length. We cut a fancy scroll on the front of the plinth, Fig. 9. This was drawn out with a combination of curve templates until it looked like something Colonial.

THE DOORS. We built frame and panel, lipped doors (described on pages 8 through 11) for the cabinet section. The dimensions of these doors is shown in Fig. 10.

FINISHING. The drawers are pretty basic — with rabbet/groove joints at all four corners and a lipped front. The construction of this type of drawer (and the drawer slides) is detailed on page 20.

FINISHING. Since this dry sink was built of pine, it's very important to check the entire surface carefully for any scratches or sanding marks. Then we applied two coats of *Minwax* Early American stain, and finished off with two coats of *Hope's* Tung Oil Varnish.

MATERIALS LIST

Overall Dimensions: 40½" x 38¼"W x 20"D	
A Cabinet Sides (12 pcs)	¾ x 3¼ - 33
B Cabinet Rails (3 pcs)	¾ x 1¾ - 35¾
C Cabinet Shelves (ply)	½ x 17 - 35¼
D Frame Stile (2 pcs)	¾ x 1¾ - 30
E Middle Stile	¾ x 1¾ - 27¾
F Top Rail	¾ x 1¾ - 34¾
G Middle Rails (2 pcs)	¾ x 1¾ - 17¼
H Bottom Rail	¾ x 2½ - 34¾
I Sink Top	¾ x 7 - 38¼
J Sink Sides (2 pcs)	¾ x 7 - 20
K Sink Front	¾ x 5 - 38¼
L Sink Back	¾ x 6 - 36¼
M Sink Bottom (6 pcs)	¾ x 3¼ - 36¾
N Base Sides (2 pcs)	¾ x 4 - 18¾
O Base Front	¾ x 4 - 37¾
P Door Rails (4 pcs)	¾ x 2 - 14½
Q Door Stiles (4 pcs)	¾ x 2 - 20
R Door Panels (8 pcs)	¾ x 3¼ - 16⅛
S Drawer Fronts (2 pcs)	¾ x 5 - 16
T Drawer Sides (4 pcs)	½ x 4¼ - 16
U Drawer Backs (2 pcs)	½ x 3½ - 14¾
V Drawer Bottom (2 pcs)	¼ x 14⅝ - 15⅝
W Cabinet Back (ply)	¼ x 35¼ - 28¾

FIGURE 10

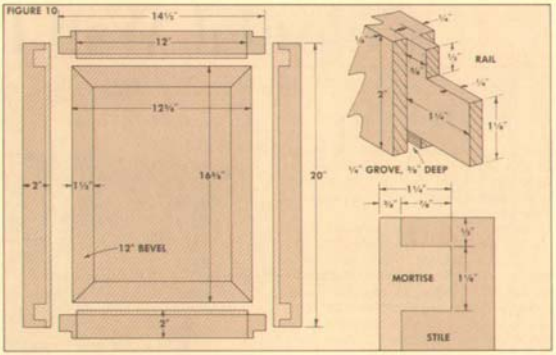
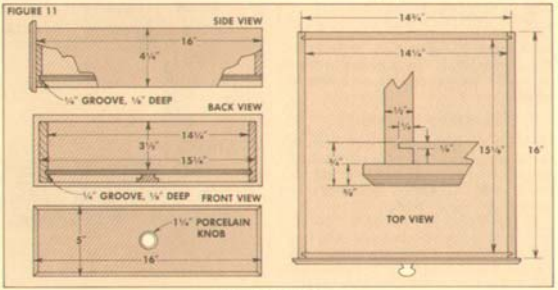
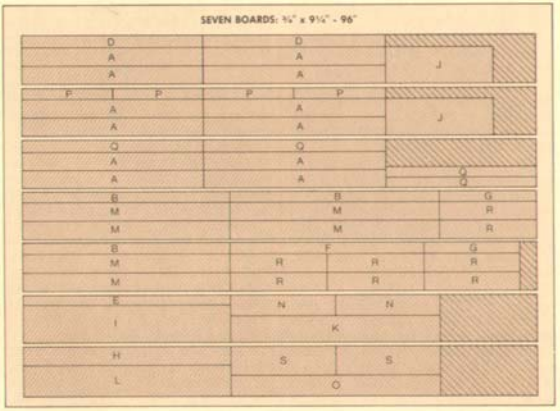


FIGURE 11



CUTTING DIAGRAM



Colonial Wall Hutch

THE GREAT WALL OF CHINA

This wall-hung china hutch was designed as a companion piece to the Dry Sink shown on the previous pages. Although the two pieces match up quite nicely (as shown on the cover of this issue), this hutch could certainly be built as a stand-alone unit.

In some respects this hutch reminds me of an old Chinese proverb: Before you ride on the back of a tiger, be sure you have a way to get off. So, skipping ahead to the last step, this hutch is designed to be hung on a wall. Hence, you might want to check out the method we used to hang it to make sure it will work for your situation. (See Shop Notes, page 23.)

There's a lot of other 'planning ahead' involved in this project — especially with the sequence of construction. In fact, a lot of this may seem like a rather strange procedure. But it seemed to work out well for us.

BUILDING THE FRAME

The basic case for this hutch is divided into two separate parts: the sides and 'shelves' are one part, and the facing frame (which is added to the top section to support the doors) is the second part.

The first step is to rip a bunch of boards to be glued up for the sides and the four 'shelves.' (These shelves are actually the top and bottom pieces for the cabinet and the drawer section, but it's easier to refer to them as shelves.) While the glue was drying on these pieces, I went ahead and built the facing frame.

FACING FRAME. It may seem like a strange procedure to build the facing frame first. But by building it before the sides, you can use it as a gauge for cutting the curved sections at the center of the sides. Also, you can use the frame to hold the sides and shelves square when it comes time to glue them together.

This facing frame is assembled with mortise and tenon joints, and has a center dividing rail, Fig. 1. After cutting the joints, I cut a groove on the back side of each stile, ¾" from the outside edge. These grooves are used to mount the frame to the side pieces. When the frame is glued up, the key thing is to make sure it's square.

BUILDING THE SIDES

The sides start out as pieces 9½" wide and 36½" long. It may seem pointless to specify a 9½" width for the sides when you could make them out of a single piece of 1x10 pine (9¼" wide). But I think it's much better to rip several narrower boards (in this case I ripped three boards 3¼" wide) and edge-glued them together.

DRAWING THE CURVES. It is very helpful at this point to draw out the basic outline of the sides. This means drawing the double curve between the cabinet and the drawer section, as well as the position of the stopped dadoes in the drawer section, and the curved 'wings' on the bottom edge of the sides, see Fig. 1.

We used some fancy curve templates purchased at an art store to draw the double curve. (This type of template is also available from the *Woodcraft Supply* catalog, 313 Montvale, Woburn MA 01888.) The shape of the curve is in no way critical, it need only look good to your eye.

After the double curve is drawn out, mark the width of the bottom drawer section (8" from the back edge), and the two stopped dadoes (stopping 7½" from the back edge). Finally draw the small curved 'wing' below the drawer section.

TONGUE FOR THE FACING FRAME. Next, while you still have straight edges to work with, cut a rabbet along the front edge of the sides, Fig. 2. The purpose of this rabbet is to leave a tongue that will eventualy fit in a groove in the facing frame. This is a nice way to join the facing frame to the case . . . without the use of nails and the resulting nail holes to fill.

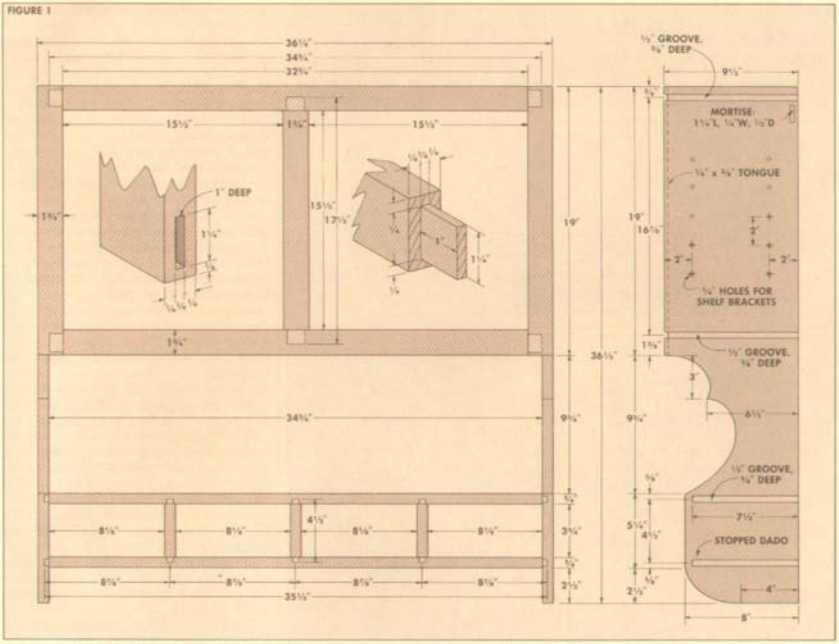
SHELF DADOES. Four dadoes must be cut for the 'shelves,' see Fig. 1. The two dadoes on top extend full width (from front to back), but the two on the bottom are stopped 7½" from the back edge.

I cut each of these dadoes ½" wide. Later a ½" tongue is cut on the ends of the shelves to fit in these dadoes. The reason for this tongue and groove joint is mostly for appearance . . . it's much easier to get a good clean fit when it's done this way, especially at the joint line.

HANGING BAR. The most critical part of this whole project is the hanging bar. I joined this bar to the sides with a mortise and tenon joint Fig. 3. Later, when the case is assembled, this bar is glued into the mortises and also to the top of the cabinet.

CUTTING THE CURVES. Now, the front edge of the drawer section should be trimmed to a width of 8" by making a partial (stopped) rip cut. This is done

FIGURE 1



before cutting the curves so you have a nice straight edge on the front of the drawer section. Then the double curve and the curve on the 'wing' are cut out with a sabre saw.

Be sure to leave enough room around the stopped dadoes so the shelves and the curves blend together. Finally, sand the edges of the curves smooth with a drum sander on a drill press.

HOLES FOR SHELF BRACKETS. The last step on the sides is to drill a series of ¼" holes to accept the shelf brackets. These little L-shaped brackets are very nice for adding an adjustable shelf.

BUILDING THE SHELVES

Now work can begin on the shelves. I glued up these shelves at the same time as the sides, so now they need to be ripped to width. To get the final length, I used the grooves in the facing frame as a gauge. The shoulder to shoulder length of the four shelves must be the same as the distance between the grooves of the frame. Add the depth of the dadoes to this measurement, and cut the boards to this length. (The

FIGURE 2

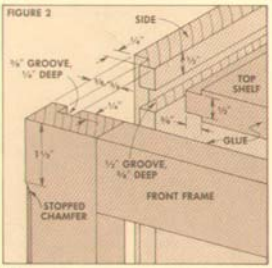


FIGURE 3

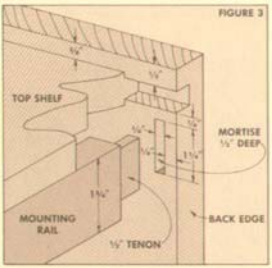
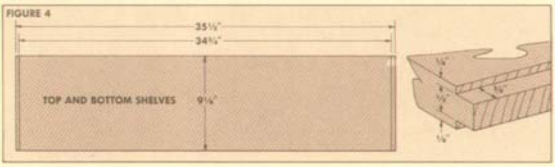
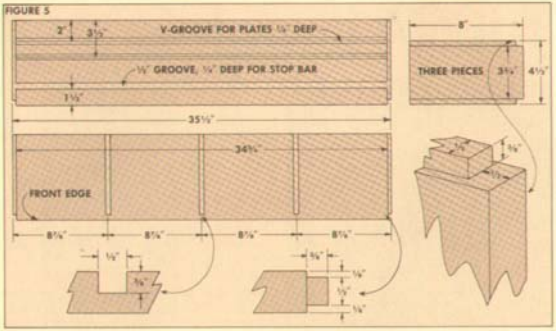
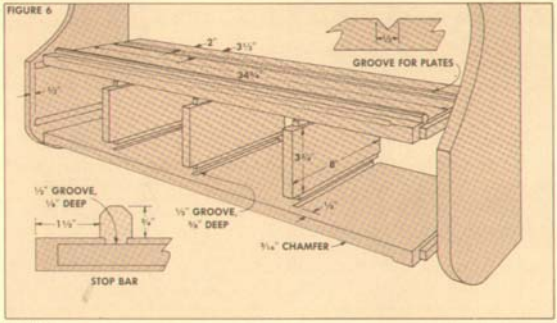
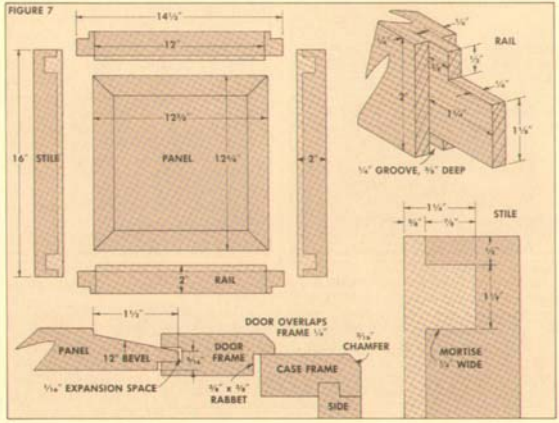


FIGURE 4









hanging bar, mentioned above, is also cut this way.)

Before cutting the tongues, I made sure all four pieces were cut to identical length. Then the rabbets are cut to form the tongues at the ends of the shelves. I made these rabbet cuts the same way tenons are cut (see page 4), making the shoulder cuts first, and then continuing out to the end with a series of cuts. The same set-up should be used on all four pieces . . . ensuring that the shoulder to shoulder distance between the tongues is equal.

When the tongues have been cut on the 'shelves' for the cabinet (top) section (Fig. 4), you're done with these pieces. However, the front ½" on the tongues of the bottom two shelves should be trimmed off to fit in the stopped dadoes.

Also, before assembly, these bottom two shelves need a series of dadoes for the drawer dividers. These dadoes are also ½" wide (Fig. 5) and stopped ½" from the front edge.

Finally, V-grooves are cut on the top side of the top shelf for displaying china, and a dado is cut for the shelf lip.

DRAWER DIVIDERS. The cabinet can now be dry-assembled to make sure everything fits, and to take final measurements for the drawer dividers. These dividers are cut the same way the shelves were, with ½" tongues to fit in the dadoes. Also the front ½" of the tongue is trimmed off to fit in the stopped dadoes, Fig. 5.

GLUING UP THE CASE. Before assembly stopped chamfers are cut on the two bottom shelves, Fig. 6. Then the basic case can be glued up.

As the sides and the shelves are glued together, place the facing frame on the tongues. This will hold everything square, and it will also force the placement of the two top shelves (set back ¼" from the end of the tongue, Fig. 2). After assembly, a chamfer is cut along the outside edges of the door frame and sides.

THE DOORS

Raised-panel doors were used for the top cabinet on this hutch. The basic step-by-step procedure for building these doors is given on pages 8 through 11 in this issue.

Briefly, measure the door opening and build the door frame a total of ½" wider than the opening (to allow for the ¼"lip on all four edges of the frame). The dimensions for the haunched mortise and tenon joints are shown in Figure 7. Here again, after assembly, chamfers are cut around all four edges of the doors.

Boards for the panel are glued up and cut to 12⅝" squares. As shown in Fig. 7, the chamfered border is cut at a 12° angle, 1½" deep. Then a rabbet is cut on the back of the panel so it fits in the ¼" groove.

To hang the doors, we used brass semi-concealed self closing hinges. (I purchased

them at a local hardware store, but they're also available from *The Woodworkers' Store* catalog, 21801 Industrial Blvd., Rogers, MN 55374 — send $1 for their catalog.) *

THE DRAWERS

The four drawers are just basic lipped-front drawers. I used rabbet/grooves joints to join the sides to the front and back, see Fig. 8.

Since these four drawers line up across the width of the hutch, it's nice if the drawer fronts are cut from a single board. This way there can be a continuation of the grain pattern from drawer to drawer.

The sides are made of ½" stock. If this is difficult to obtain, simply resaw some ¾" stock down to size. (To do this set the blade height at about 1¾" and make a 'rip' with the board on edge.)

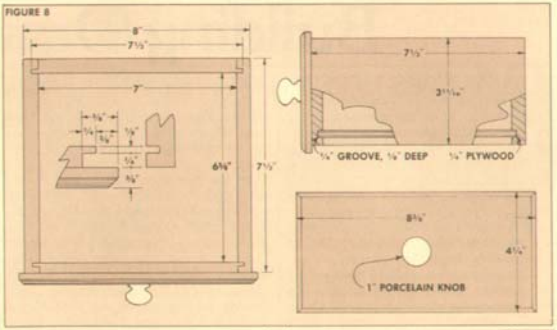
THE CORNICE

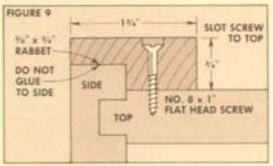
For the crowning touch I added a shop-made cornice, Fig. 11. The first step for this was to build a mounting brace along the three edges of the hutch, Fig. 9. To this I added a frame with chamfered edges, and a ¾" corner cove piece (purchased at a lumber yard). This cove piece is glued to the top chamfered piece and the mounting brace, but not to the sides of the case, see Fig. 10.

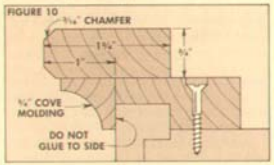
FINISHING. We finished this hutch with two coats of *Minwax* Early American stain. Then for the top coat, we used *Minwax* Antique Oil Finish. This oil is very nice to use (just wipe it on), and you don't have to worry about drips and runs. It yields a satin sheen that gives the hutch a mellow (almost aged) look.

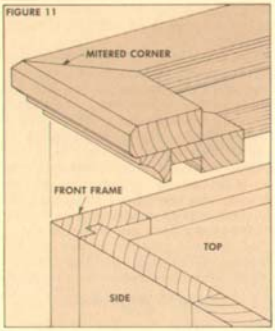
MATERIALS LIST

Overall Dimensions: 36½"H x 36¼"W x 10"D	
A Cabinet Sides (6 pcs)	¾ x 3¼ - 36½
B Cabinet Top (3 pcs)	¾ x 3¼ - 35½
C Cabinet Bottom (3 pcs)	¾ x 3¼ - 35½
D Mounting Rail	¾ x 1¾ - 33¾
E Cabinet Shelf (3 pcs)	¾ x 3¼ - 35½
F Frame Stiles (2 pcs)	¾ x 1¾ - 19
G Frame Rails (2 pcs)	¾ x 1¾ - 34¾
H Frame Middle Rail	¾ x 1¾ - 17½
I Drw. Section Top	¾ x 3¼ - 35½
J Drw. Section Btm	¾ x 3¼ - 35½
K Drw. Section Dividers	¾ x 8 - 4½
L Plate Stop	¾ x 1 - 34¾
M Door Rails (4 pcs)	¾ x 2 - 14½
N Door Stiles (4 pcs)	¾ x 2 - 16
O Door Panels (8 pcs)	¾ x 3¼ - 12⅛
P Fillet Backing	¾ x 1¾ - 60
Q Fillet Top	¾ x 1¾ - 60
R Fillet Cove	¾ x ¾ - 60
S Drawer Front (4 pcs)	¾ x 4¼ - 8⅝
T Drawer Sides (8 pcs)	½ x 3 11/16 - 7½
U Drawer Back (4 pcs)	½ x 3 11/16 - 7½
V Drawer Bottoms	¼ x 7¼ - 7¼
Cabinet Back (ply)	

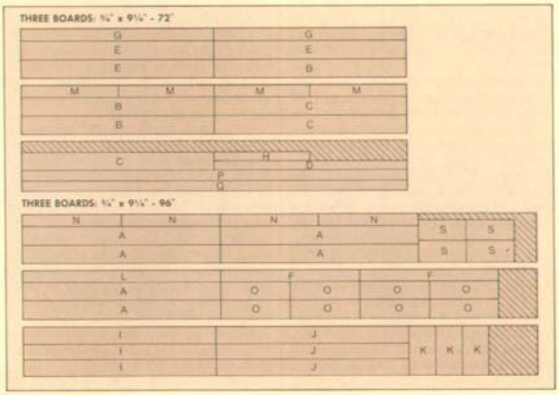








CUTTING DIAGRAM



Building Drawers

MAKING LIPPED DRAWERS WITH RABBET/GROOVE JOINT

I'm not going to pull any punches: one of the toughest things in all of woodworking is building a drawer. Just getting it put together is one thing, but then you have to get it to fit . . . no small task.

The drawers for the three main projects in this issue are all built the same way. Each is joined with a rabbet/groove joint, and the drawer front is lipped (so the lip extends over the cabinet's frame).

If these drawers were flush mounted (so the drawer front was flush with the frame), you'd have to be very careful about the fit. However, the lipped drawer front allows some degree of 'sloppiness' in the fit . . . at the expense of more problems in cutting the joint.

The basic steps involved in cutting rabbet/groove joints are shown on the next page. But before making any sawdust, we had to make some decisions: 1) We wanted to build a lipped drawer. 2) All four edges (lips) would extend ¼" over the frame. 3) The *thickness* of the lip would be ⅜" (to match the doors). 4) The drawer fronts would be made of ¾"-thick stock. 5) The drawer sides would be ½"-thick stock. 6) All four corners would be joined with rabbet/groove joints (not as good as a half-blind dovetails, but a pretty good joint for drawers). 7) And finally, the drawers would have center-mounted drawer slides.

CUTTING THE RABBETS

The first step is to cut the piece for the drawer front to size. Measure the opening in the frame and add a total of ½" to both dimensions. (This allows for the ¼" lip on all four edges.) Next, rabbets are cut on the top and bottom edges of the drawer front.

1. RABBET ON BOTTOM EDGE. The rabbet on the bottom edge is ⅜"-deep and ¼" wide. Since the drawer front is cut from ¾"-thick stock, the ⅜"-deep rabbet will leave a corresponding ⅜"-thick lip on the drawer front.

The width of the rabbet is ¼". We wanted the lip to extend ¼" over the frame. Since the drawer rests on the frame, the shoulder of the rabbet must be ¼" from the bottom edge of the drawer.

To make the first cut for this rabbet, I set the blade ⅜" high, and set the fence ¼" from the outside of the blade, and made the cut, Fig. 1. Before making the second cut to finish the rabbet, it's easier to make the first cut for the rabbet on the top edge.

RABBET ON TOP EDGE. There are two options for the rabbet on the top edge . . . depending on the way the drawer is mounted in the case. Example 1: If the cabinet itself is used as a guide for the drawer, then the top rabbet (and also the drawer's sides) are cut to leave the ¼" lip plus a short 1/16" clearance. This is the way the small drawers on the Hutch were made.

Example 2: For larger drawers where a drawer guide system is used to hold the drawer steady, the rabbet can be larger. The rabbet on the top edge (and also the drawer's sides) is cut to leave the ¼" lip, plus an additional ¼" for clearance. This is the way the drawers on the Dry Sink and Bed-Side Stand were made.

To make this cut, the height of the blade is already set at ⅜" (from the last cut on the bottom rabbet). Move the fence so it's 5/16" (example 1) or ½" (example 2) from the outside of the blade. (This ½" cut, example 2, is shown in Fig. 1.)

2. FINISH RABBETS. To finish the rabbet on the top edge, set fence so it's ⅜" from outside of blade, and blade height at 5/16" or ½" (shown on left, Fig. 2).

To finish bottom rabbet, keep fence at same position and lower the blade to ¼" high (shown on right in Fig. 2).

DRAWER FRONT

Now it's a matter of cutting the rabbet/groove joint on the both ends of the front piece. The layout of this joint can get a little confusing.

Basically the rabbet/groove joint is a partial rabbet cut on the drawer front. I say partial rabbet because a tongue is left to fit in a groove (dado) that's cut in the drawer sides.

4. CUTTING THE RABBET. The partial rabbet is cut by standing the drawer front on end. The fence is already positioned ⅜" from the inside of the blade (from the last cut made on the bottom edge). The blade is raised to the proper height.

Once again, there are two options for setting the blade height. To determine this, you must allow for three things: 1) The ¼" lip on the end of the drawer front. 2) The width of the drawer side, which in this case is ½". And 3), the amount of clearance between the drawer side and the side of the case. If the case acts as a drawers guide (example 1), add a short 1/16" for clearance. If there's a drawer guide system (example 2), you can have as much clearance as you want. But for these drawers I used 1/8".

Adding up these figures gives you a blade height of 13/16" or ⅞". (Making this cut is shown on the left in Fig. 4.)

LEAVING THE TONGUE. The next cut must be precise. Adjust the fence to leave a narrow tongue. (Shown on right, Fig. 4.)

The best result here is to leave a tongue that's exactly as wide as the saw blade. If the tongue is a little too wide, there will be extra work when cutting the groove in the drawer side. But the worst problem is leaving a tongue that's too narrow. Then there's no way to cut the groove in the side so the tongue will fit.

5. TRIMMING OFF THE TONGUE. In the sequence of drawings, we're showing the tongue being trimmed to length now, Fig. 5. Actually you could cut the groove (in the drawer's sides) first and then trim the tongue to fit. When cutting the tongue, it's best to clamp a small stop on the fence to allow clearance for the scrap.

GROOVE IN SIDES

To complete the joint on the drawer front a groove (dado) must be cut in the drawer's sides. First, cut the sides to size. The width of the sides is the same as the shoulder to shoulder distance between the top and bottom rabbets on the drawer front. The length of the sides is about 1" or 2" less than the depth of the case.

Now, to line up the groove, use the drawer front as a gauge to set the fence, Fig. 7. The blade is set ¼" high (or to the length of the tongue if you've already cut it). To make the cut, hold the side steady with the miter gauge and shove the end up against the fence, Fig. 8. Test the fit on the drawer front and widen the groove if necessary, Fig. 9.

JOINT FOR DRAWER BACK

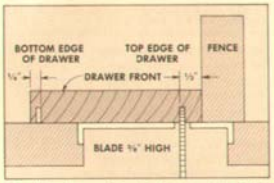
We're on the home stretch now. All that remains is the rabbet/groove joint for the drawer's back. Fortunately, this one is a whole lot easier, but the sequence of cuts is a little different because you don't have to allow for a lip.

First, set the blade ¼" high and use the drawer back to align the fence, Fig. 10. Then make the dado cut in the drawer side, as described above.

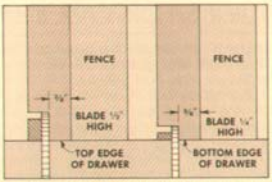
Reset the blade height to the bottom of this groove (Fig. 11), and adjust the fence to leave a ¼"-long tongue. (Sneak up on this cut, checking the fit as you go.)

ASSEMBLY. The drawer can now be dry-assembled to see if everything fits. Be careful here because the tongues are very fragile. If everything checks out, the last step before assembly is to cut the grooves for the drawer bottom. For the drawers using a drawer guide system, I cut these grooves ½" from the bottom edge.

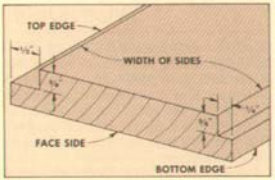
Step By Step



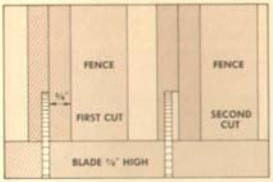
1 *The drawer front is first cut to width and length. Then set the blade ⅝" high and adjust the fence to make first cuts for the rabbets on the top and bottom edges.*



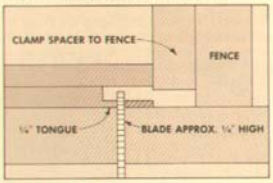
2 *To finish the rabbets on the top and bottom edges, set the fence ⅝" from the inside of the blade and adjust the blade height to match the first rabbet cut.*



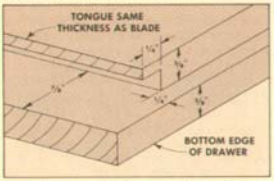
3 *The finished cuts will look something like this. Note that the distance between the two shoulders of the rabbets will be the same as the width of the sides.*



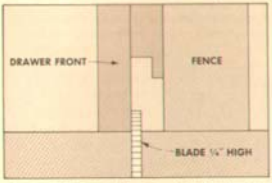
4 RABBET/GROOVE. *The first cut for the rabbet/groove joint is made with the fence ⅝" from the blade. Readjust fence so second cut to leaves a narrow tongue.*



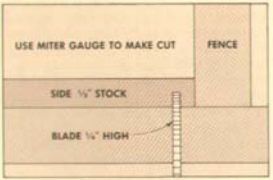
5 *To finish the tongue, clamp a spacer to the fence and adjust fence to leave a tongue ¼" long. (This step can be done after cutting the groove in the side.)*



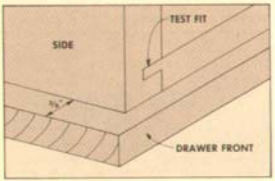
6 *The completed cut on the end of the drawer front looks like this. Be sure the tongue is at least as thick (or a little thicker) as the width of the blade.*



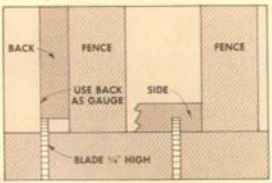
7 GROOVE CUT. *To align the first cut on drawer side, use the drawer front as a gauge. Raise the blade to a height equal to the length of the narrow tongue.*



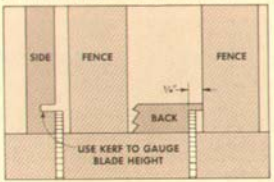
8 *It's best to make this first cut in a try-piece first. Hold piece with miter gauge and push firmly against fence. Test fit with the tongue on drawer front.*



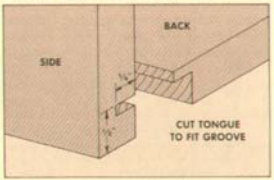
9 *This is the completed joint. Be careful when testing fit because the tongue is very fragile. Note that lip allows ¼" for overlap on frame and ⅛" for clearance.*



10 DRAWER BACK. *First cut to join the drawer back is made on the side piece. Use the drawer back to gauge the position of the fence. Raise blade ¼" high.*



11 *Now use the dado cut on the drawer side to reset the blade height. Adjust the fence to leave a ¼"-long tongue to fit in the groove in the side piece.*



12 *When the tongue fits the groove, the joint for the drawer back is complete. Now grooves for the drawer bottom can be cut in drawer's sides and front.*

Drawer Guides

WOODEN GUIDES FOR WOODEN DRAWERS

Of all the challenges for a woodworker, building a drawer has to rank near the top of the list. Just getting it built to the proper size is problem enough. But it must also function smoothly . . . slide easily as it's opened and closed, without binding. This is where drawer slides (or guides) enter the picture.

For the drawers in the Dry Sink and the Bed-Side Stand in this issue, I used a wooden, interlocking T-bar system. Basically, a T-shaped bar is mounted to the bottom of the drawer, and a pair of retainer bars are mounted to the drawer shelf in the cabinet. The T-bar has two functions: It aligns the drawer so it doesn't bind as it's opened, and it also prevents the front from dipping when the drawer is pulled out more than halfway.

Each of the three bars starts out as a 1"-wide strip of maple or birch. These strips are resawn (ripped on edge) to a 7/16" thickness. Normally all three bars are cut to match the length of the drawer. However, the T-bar can be cut longer for greater stability. Then it's just a matter of cutting 1/4" x 1/4" rabbets on the edges of each bar as shown in Fig. 1.

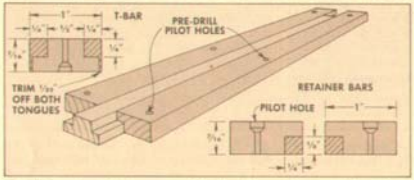
MOUNTING THE SLIDES

To mount the bars, first clamp the T-bar on the center line of the drawer shelf. Then place the two retainer bars beside it, leaving very slight clearance. Screw them in place — but don't use glue in case adjustments have to be made later.

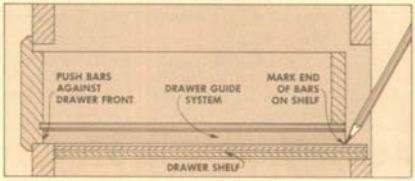
Now fasten the T-bar on the center line of the drawer bottom. Countersink the screws but make sure they don't poke through the drawer bottom.

The key thing in both of these steps is to take your time — make sure the T-bar is centered on the drawer bottom and the retainer bars are centered on the shelf.

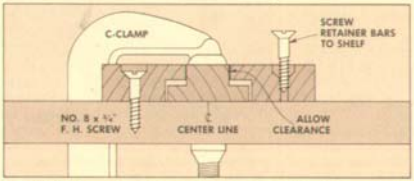
It will probably take a few adjustments to get everything lined up. But once they're in place, the drawers will slide like they're floating on air.



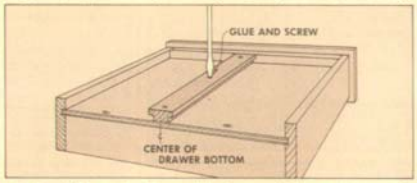
1 *Three 1"-wide bars are cut to length, and resawn (ripped on edge) to 7/16" thickness. Then 1/4" x 1/4" rabbets are cut on the corners, and counterbored pilot holes are pre-drilled.*



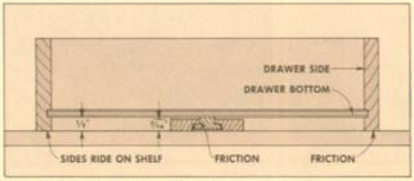
2 *Slide the finished drawer into the cabinet and position the bars under the drawer. Since this slide system also acts as a stop, carefully mark the position of the end of the bars on the shelf.*



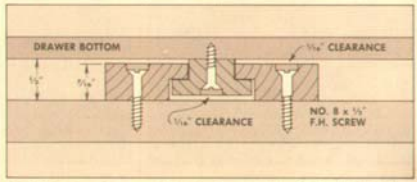
3 *Mark the center line of the drawer shelf. Also mark the center of the T-bar. Clamp the T-bar to the shelf, position the retainer bars next to it, and screw them to the shelf.*



4 *Mark the center line on the drawer bottom and screw the T-bar in place. Use 1/2" screws counterboring them, but make sure the screws don't poke through the drawer bottom.*



5 *Slide the drawer in place now. There should be three friction points: the two drawer sides should slide on the drawer shelf, and the T-bar should be snug against the retaining bars.*



6 *This is a close-up of the final assembly. Undoubtedly there will be a need for minor adjustments. When it finally fits, apply a coat of wax to the T-bar assembly, but no finish.*

Shop Notes

TIPS FROM THE SHOP

GRAIN PATTERNS

When making a raised panel, two grain patterns become quite distinct: one on the field (the raised portion in the center of the panel), and another on the chamfered border. These patterns are particularly prominent if pine is used for the panel.

It wasn't until I was building the panels for the Bed-Side Stand shown in this issue that I discovered how the panel should be cut for the best effect. The key to the whole thing is which side of the board the chamfered borders are cut.

Look at the grain patterns on the panel on the left in photo. There's a nice straight-grained pattern on the sides, and a 'crowned' pattern on the top (end). This is what I was after.

To get this effect, you must make your cuts according to the sweep of the grain (the annular rings) on the end of the panel (end grain). If the annular rings are concave to the field (at left in the drawing), you'll get a straight grain pattern on the two long edges, and the top and bottom will have the crowned pattern.

By simply flipping the board over when cutting the chamfered edges, the grain pattern will be less desirable. As shown on the right in the photo, you'll get a flat grain pattern on the long sides and a curled-up pattern on the ends.

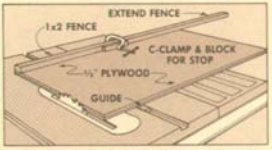
Even if you're gluing up boards, these same results can be achieved by positioning the outside boards with the end grain in the proper pattern. Then it's just a matter of selecting the wood (grain patterns) so the field has a continuity to it.

PANEL CUTTING JIG

Whenever you glue up several boards to form one wide panel (or slab), you're faced with a problem: how do you square up the ends? I use a very simple panel cutting jig.

The jig is simply a piece of ½" plywood with a 1x2 fence on the back edge, and a guide bar underneath. To make it, cut a piece of hardwood (maple or birch) for the guide bar. Place this in the channel of the table saw so it has a snug, but smooth-sliding fit. (Apply some furniture wax for better sliding action.)

Now cut a piece of ½" plywood to the size you want (mine is 16" x 30"). Place the



guide bar in the channel and spread glue along the top of the guide bar. Then position the plywood on top of the guide bar so the right end of the plywood extends about ½" beyond the path of the blade.

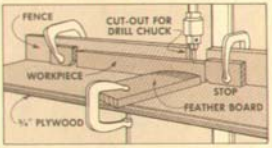
Use some small brads to temporarily tack the plywood to the hardwood guide bar. Then pick it up and turn it over to drill pilot holes and drive screws to secure these two pieces together. Return this assembly to the saw and push the plywood through the blade to cut off the right end. This way you know the end of the plywood is exactly on the path of the blade.

The last step is to add the 1x2 fence. Crank the blade to its full height and use a large framing square to position the fence. Glue and screw it in place. Then clamp a stop to the fence and make some trial cuts on a wide board to see if everything is square.

On a radial arm saw, the procedure is similar, except the saw head is rotated to a rip position and the guide bar is set so it rides against the outside of the table.

FENCE FOR DRILLING MORTISES

I think the easiest way to rough out a mortise is on a drill press. To make the job easier and more accurate, I use the jig shown in the drawing below.



This jig is simply a ¾" plywood base (12" x 48") with a 3"-high fence. The fence is housed in a dado 2" from the back edge of the base and is strengthened with triangular blocks on the back. Also, there's a small notch on the top edge to allow the drill chuck to clear. The key thing here is to make sure the fence is exactly perpendicular to the base.

To align the jig for cutting mortises, first mark an "x" on the outside face of the workpiece. Then clamp the jig to the drill press table, and hold the "x" side of the workpiece firmly against the fence.

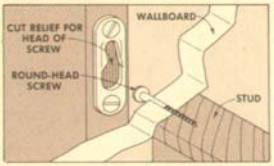
Now drill a shallow (trial) hole in the work-piece. Turn the workpiece around so the "x" side is out and lower the bit to see if it enters the first hole. Adjust the position of the jig until the bit drills the same hole.

Now that the jig is aligned I go ahead and mark out the position of the mortise. Then I clamp some stop blocks on the fence so I know each mortise will be cut exactly the same size and in the same position.

WALL MOUNTING HARDWARE

Building a wall-mounted cabinet or hutch is the easy part. Getting it fastening to the wall (so it stays there) is a headache. One type of hardware that can solve this problem is shown in the drawing below.

This key-hole shaped bracket is actually designed for knock-down furniture, but



works well for mounting narrow shelves to a wall. To hang the shelves, fasten round-head screws into the wall. If the shelf is relatively light-weight, toggle bolts or wall anchors can be used.

For heavier cabinets, the screws should be driven into the studs. In this case, it's beneficial to have a mounting bar on the back of the cabinet (as on the Hutch in this issue), so the brackets can be positioned 16" apart (the distance between studs).

Before the hardware is screwed into the back of the shelf (or on the mounting bar), a small groove must be cut to allow room for the head of the round-head screw.

This hardware is available from *The Woodworkers' Store* Catalog in two configurations: a single keyhole (No. D3963, $.45 per pair) or double key-hole (No. D3962, $.60 per pare). Send $1 for their catalog. The address is: 21801 Industrial Blvd., Rogers, Minnesota 55374.

Note Board

A CLASSIC PIN-UP

Just as we finished this note board, a friend of mine stopped by the shop to ask about making mortise and tenon joints. This seemed like the perfect project to get some hands-on experience.

The four pieces for the frame must be cut and joined so the final dimensions accommodate a 12"x12" cork board panel.

The stiles (verticle pieces) are cut to width and length, (Fig. 1), and then the mortises are cut. The two rails (horizontal pieces) start out 3¼" wide, and tenons are cut to match the mortises, but the top edge of the tenon is trimmed to leave a 1¼"-high shoulder above the end of the stile.

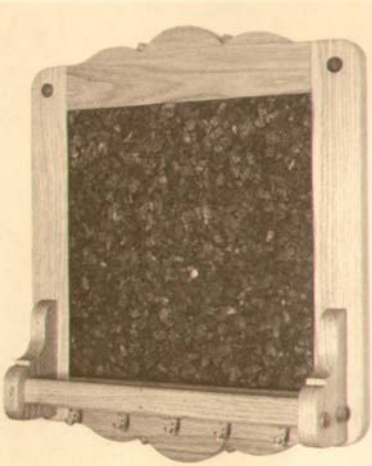
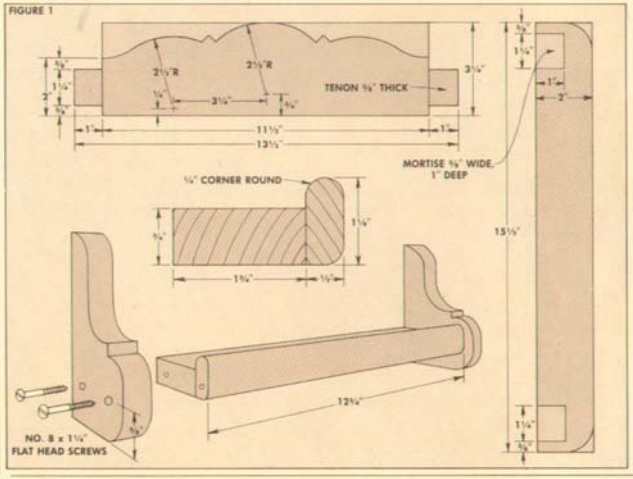
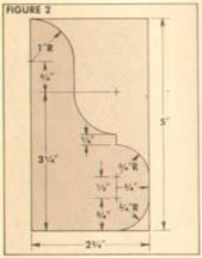
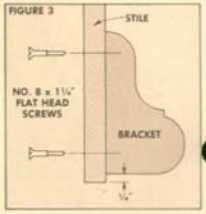
After cutting the jonts, the frame is dry-assembled and the scroll-work is drawn on the two rails, and cut out. I added the two "diamonds" in this pattern by bandsawing a "V" shape and then used a chisel to trim the front corners to shape. Then all edges are sanded.

After gluing-up the frame, I rounded the four corners (on the stiles), and then routed a ¼"-wide rabbet on the back edge deep enough to hold the cork board (½").

With a little finish sanding the frame could be used just like this. But I added the tray to hold pins and pencils.

The outline of the two brackets for the tray are sketched out as shown in Fig. 2, and band sawn to shape.

The L-shaped tray consists of a bottom piece and a facing lip. The lip is resawn (ripped on edge to ½" thickness) and three edges are rounded over. Then these two pieces are glued and clamped together.

I glued and screwed the brackets to the tray, counterboring the pilot holes and covering them with buttons. Finally this tray assembly is glued and screwed to the frame, Fig. 3.

I finished this oak note board with *Watco* Danish Oil, and then glued the cork board into the rabbet.